

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Civil Engineering
B.Tech. (Second Year, IIIrd Sem.) Major Examination (Odd) 2019-20)

Entry No:

Date: 09-12-2019

Total Number of Pages: [02]

Total Number of Questions: [07]

Course Title: Geotechnical Engineering-I

Course Code: CEL 2061

Time Allowed: 3.0 Hours

Max Marks: [50]

Instructions/Note

- i. Attempt All Questions.
- ii. Support your answer with neat freehand sketches/diagrams/ graph, wherever appropriate.
- iii. Assume an appropriate data / information, wherever necessary / missing

Qst.	Section - A	Marks	CO
Q1.	Choose the correct answer:		
	(a) At Shrinkage limit, the soil is:		
	i. Dry	iii. Partially saturated	
	ii. Saturated	iv. Submerged	[01] CO1
	(b) The soils which plot above the A-line in the plasticity chart are:		
	i. Clayey soils	iii. Silty soils	[01] CO2
	ii. Sandy soils	iv. Organic soils	
	(c) The behaviour of clay is governed by:		
	i. Mass energy	iii. Both (i) & (ii)	
	ii. Surface energy	iv. Neither (i) & (ii)	[01] CO2
	(d) The hydraulic gradient is equal to the ratio of:		
	i. Total head to total length	iii. Slope of flow line	
	ii. Slope of equipotential line	iv. Head loss to length of flow field	[01] CO2
	(e) When consolidation of a soil occurs, the degree of saturation:		
	i. Increases	iii. Decreases	
	ii. Remain constant	iv. May increase or decrease	[01] CO3
	(f) Coulomb's equation for shear strength can be represented as:		
	i. $c = s + \sigma \tan \phi$	iii. $c = s - \sigma \tan \phi$	
	ii. $s = \sigma + c \tan \phi$	iv. $s = c - \sigma \tan \phi$	
Q2.	(a) What is the effect of compaction on the engineering properties of soil?	[01]	CO4
	(b) Describe clearly one method of computing coefficient of consolidation, given by Oedometer test data.	[04]	CO3
		[04]	CO3
	Section - B		
Q3.	(a) The soil profile at a building site consists of dense sand up to 4 m depth, normally loaded soft clay from 4 m to 6.5 m depth, and stiff impervious rock below 6.5 m depth. The sand has a unit weight of 20 kN/m ³ . For the clay, unit weight is 18 kN/m ³ , compression index is 22% and initial void ratio is 1.30. Calculate the final settlement of the clay layer due to an increase of pressure of 30 kN/m ² . Also calculate the settlement when the water table rises to the ground.	[04]	CO1
	(b) The following data refers to a silty clay that was assumed to be saturated in the undisturbed condition. On the basis of the data given below, determine the <u>liquidity index</u> , sensitivity, and void ratio of the saturated soil. Classify the soil according to the Unified soil classification systems.	[04]	CO3

Assume $G=2.7$.																								
	<table border="1"> <thead> <tr> <th>Properties of soil sample</th> <th>Undisturbed</th> <th>Remolded</th> </tr> </thead> <tbody> <tr> <td>Strength (kN/m^2)</td> <td>244</td> <td>144</td> </tr> <tr> <td>Water content (%)</td> <td>22</td> <td>22</td> </tr> <tr> <td>Liquid limit (%)</td> <td>--</td> <td>45</td> </tr> <tr> <td>Plastic limit (%)</td> <td>--</td> <td>20</td> </tr> <tr> <td>Shrinkage limit (%)</td> <td>--</td> <td>12</td> </tr> <tr> <td>% passing no. 200 sieve</td> <td>--</td> <td>90</td> </tr> </tbody> </table>	Properties of soil sample	Undisturbed	Remolded	Strength (kN/m^2)	244	144	Water content (%)	22	22	Liquid limit (%)	--	45	Plastic limit (%)	--	20	Shrinkage limit (%)	--	12	% passing no. 200 sieve	--	90		
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Q4.	Explain the principle of the direct shear test. with neat diagram. What are the advantages of this test? What are its limitations?	[06]	CO4																					
Q5.	A horizontal stratified soil deposit consists of three layers each uniform in itself. The permeability of these layers are: $8 \times 10^{-1} \text{ cm/s}$, $52 \times 10^{-1} \text{ cm/s}$, and $6 \times 10^{-1} \text{ cm/s}$, and their thicknesses are 7 m, 3m and 10 m respectively. Find the effective average permeability of the deposit in the horizontal and vertical directions.	[06]	CO2																					
Q6.	A homogeneous earth dam has a top width of 6 m and a height of 42 metres with side slopes of 3 (horizontal) to 1 (vertical) and 4 (horizontal) to 1 (vertical) on the upstream side and downstream side respectively. The free board is 2 m. There is a horizontal filter at the base on the downstream side extending for a length of 60 m from the toe. The coefficient of permeability of the soil is $9 \times 10^{-2} \text{ mm/s}$. With the help of flow net, find the quantity of seepage per day for 100 metre length of the dam.	[06]	CO2																					
Q7.	<p>When an undrained triaxial compression test was conducted on specimens of clayey silt, the following results were obtained:</p> <table border="1"> <thead> <tr> <th>Soil sample</th> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>Chamber pressure (kN/m^2)</td> <td>80</td> <td>150</td> <td>210</td> </tr> <tr> <td>Max deviator stress (kN/m^2)</td> <td>175</td> <td>240</td> <td>300</td> </tr> <tr> <td>Pore pressure at max deviator stress (kN/m^2)</td> <td>45</td> <td>50</td> <td>60</td> </tr> </tbody> </table> <p>With the help of Mohr circle, determine the values of shear parameters considering (a) total stresses and (b) effective stresses.</p>	Soil sample	1	2	3	Chamber pressure (kN/m^2)	80	150	210	Max deviator stress (kN/m^2)	175	240	300	Pore pressure at max deviator stress (kN/m^2)	45	50	60	[10]	CO4					
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Course Outcomes

Students will able to:

- CO1. Find the index and engineering properties of the soil.
- CO2. Determine properties & demonstrate interaction between water and soil.
- CO3. Analyze and compute principles of compaction and consolidation of soil.
- CO4. Evaluate the stresses in the soil mass.

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1(a), 3(a)	5	59
CO2	1(b), 1(c), 1(d), 5 & 6	15	59
CO3	1(e), 2(a), 2(b)& 3(b)	13	59
CO4	1(f), 4 & 7	17	59